Chapter Four: Contents

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Chapter Four—Microsimulation

1. Configuration File Keys

The following is a typical set of values for important Traffic Microsimulator configuration file keys. See Volume Eight (*Appendix: Scripts, Configuration Files, Special Travel Time Functions*), Chapter Eleven (*MS-7*) for a complete configuration file.

```
CA_SIM_STEPS                    86400
CA_OFF_PLAN_EXIT_TIME           10
CA_MAX_WAITING_SECONDS          86401
CA_LOOK_AHEAD_CELLS             35
CA_HELP_LOST_TRAVELERS          1
CA_INTERSECTION_CAPACITY        1

LOG_CONTROL                     1
LOG_ROUTING                     1
LOG_TIMESTEP                    1
LOG_TIMING                      1

PLAN_FILE                       $TRANSIMS_ROOT/plans/RS13/RS13
VEHICLE_FILE                    $TRANSIMS_ROOT/vehicle/vehicles.pop
VEHICLE_PROTOTYPE_FILE          $TRANSIMS_ROOT/data/allstr.prototypes.short

PAR_SLAVES                      47
PAR_MIN_CELLS_TO_SPLIT          10
PAR_USE_METIS_PARTITION         1
PAR_USE_OB_PARTITION            0
PAR_PARTITION_FILE              $TRANSIMS_ROOT/data/partition.47
```

1.1 Notes on Configuration File Key Values

The Traffic Microsimulator crashes if any one of its output files grows larger than 2 Gbytes. We break up the snapshot data into several time periods to avoid this. Especially later in the day and early in the stabilization process, there are hundreds of thousands of vehicles trapped in jams and the snapshot files grow large quickly. One could also stop the simulation earlier, since very little important information is collected after the jams develop.

We experimented with allowing vehicles to become off-plan more quickly. It turns out that, since vehicles become off-plan by waiting only if they are stopped at an intersection, it is not possible to clear jams very quickly. The configuration file key `CA_MAX_WAITING_SECONDS` must, in any case, be longer than the longest red light phase, so at most only one vehicle can be removed every few minutes from a jammed link in this fashion.

The configuration file key `CA_OFF_PLAN_EXIT_TIME` should be set low so that vehicles that do become lost for any reason do not contribute to jams; they exit the simulation at the next parking lot they pass. They will continue with the rest of their tour, however, as if they had reached their destination, because the `CA_HELP_LOST_TRAVELERS` flag is set.

It became clear in early runs of the Traffic Microsimulator that vehicles that became off-plan while on a freeway had little chance of exiting the freeway to find a parking lot. We, therefore, created an alternative table of parking lots for use only by the Traffic Microsimulator that provides a parking lot for every freeway or expressway link. Because the Route Planner never sees these extra lots, they are not included in any driver's plan. Hence, they will be used only by drivers who are off-plan.

The vehicle file specifies that all vehicles have a length of one cell. We determined that the effort required to remove all short links was not worth the slight gain in verisimilitude of longer vehicles. Heavy-duty vehicles have appropriately modified maximum speeds and powers.

2. BUG FIXES

We have fixed a few errors in the Traffic Microsimulator that reduced capacity:

- Vehicles executing a U-turn on a link that allowed U-turns on both ends became stuck on that link.
- Vehicles entering a link in a two-lane merge section sometimes became stuck hopping between lanes.
- Vehicles occasionally became stuck in intersections. This was related to the U-turn problem.

3. Changes in Logic

We made a few changes in driving logic based on observed unrealistic behavior.

Vehicles that cannot change into their desired lane because of congestion are allowed to proceed onto any lane on their next link when they reach an intersection. If there is no connectivity from their current lane to the next link, they will become off-plan immediately. This was required to prevent traffic in every lane of a freeway from stopping at the end of the link before a congested exit ramp.

4. Computing Environment

All Traffic Microsimulator runs were carried out on a 128-node Linux cluster using up to 48 of the nodes. Each node contains two 500 MHz CPUs sharing 1 Gigabyte of memory. In order to reduce the memory required by the Traffic Microsimulator, we distributed the computation to 47 slaves, placing only one slave on each node. The resulting memory usage per node was roughly 200 – 400 Megabytes. This indicates that we could have used both processors on each node, but we did not typically do so. We also could have distributed work to more slaves, but the cluster hardware was less likely to fail when we minimized the number of slaves.

Total output disk space required for any run was under 5 Gigabytes. A breakdown by file and run is provided in the three tables below. The output disk space requirements were dominated by the vehicle snapshot data, summary data, end-of-trip events, and logging messages. Summary data and end-of-trip events are required for Route Planner feedback; snapshot data proved valuable for understanding the progress of the iterations; logging messages could be turned off with no ill effects.

Table 1. File sizes for those files that did not vary significantly from run to run.

File name	File size
cutline.transit.trv	46 K
cutline.truck.tim	1 – 2 M
cutline.auto.tim	1 – 2 M
run_time_monitor	4 M
summary.noflow.dens.spa	116 K

Table 2. File sizes in Kilobytes (K) or Megabytes (M) for non-snapshot Traffic Microsimulator output files that varied in size from run to run. Some of these provide gross measures of performance. For example, the number of off-plan travelers should decrease with iteration.

Iteration number	anomaly. offplan.trv (M)	anomaly. other.trv (K)	busmall. snapshot.veh (M)	endsim.trv (M)	endtrip.trv (M)	Logfile (M)	snapshot.am.int (K)	summary. dens.spa (M)	summary. dens.tim (M)	summary. noflow.dens.tim (M)
20	72	65	23	35	773	592	383	429	507	112
19R	70	3	23	39	750	618	380	417	491	113
19	68	89	23	38	743	609	396	413	489	111
18	61	99	21	44	663	644	450	387	428	137
17	38	15	2	55	529	101	720	350	352	167
16	34	3000	2	59	663	99	792	331	321	171
15	29	16	1	61	445	100	916	312	279	182
14	27	16	2			57	897	177		
12R	28	27	2	54		101	880			
12	24	1				83				
11R	29	2000	2	55		100	904			
10R		6000	3	53			1000			

Table 3. File sizes in Megabytes (M) for snapshot output. The day was broken into several different time intervals to ensure that individual output files remained smaller than 2 Gigabytes. The file size is proportional to the average number of vehicles present per timestep; extremely large files indicate the presence of large traffic jams.

Iteration number	allstr.snapshot.veh (M)	snapshot.am.veh (M)	snapshot.pm.veh (M)	snapshot.12to4pm.veh (M)	snapshot.4to8pm.veh (M)	snapshot.8to9pm.veh (M)
20		154		254	478	156
19R		155		261	522	174
19		160	913			
18		195	1180			
17		301	1600			
16		348	1780			
15		424	1940			
11R		342				
7	521					